MANPRINT
Quarterly

July 2001

Getting The Word Out…

ATTENTION MANPRINT PRACTITIONERS

– "Believe It Or Not" – AR 602-2, Manpower and Personnel Integration (MANPRINT) in the System Acquisition Process went up on the USAPA Web Site

http://www.usapa.army.mil

on 18 June 2001. It has an issuance date of June 1, 2001, and an effective date of July 1, 2001.

Contents…

Meetings of Interest

Association of the United States (AUSA) Annual Meeting
16-18 October 2001

Marriott Wardman Park Hotel
2660 Woodley Road
Washington, DC 20008

Omni Shoreham Hotel
2500 Calvert Street, N.W.
Washington, DC 20008

Metro Rail Red Line: Woodley Park / Zoo Station
Non-members of the AUSA may register at the Marriott Wardman Park Hotel

The Interservice/Industry Training, Simulation & Education Conference
26-29 November 2001
Orlando, FL
See: http://www.iitsec.org/

Comanche Supportability

PREFACE

This article is reprinted from the November 30, 2000 ARMY Aviation Magazine which is the official publication of the Army Aviation Association of America. "Comanche Supportability" was written by Mr. Charles Reading.

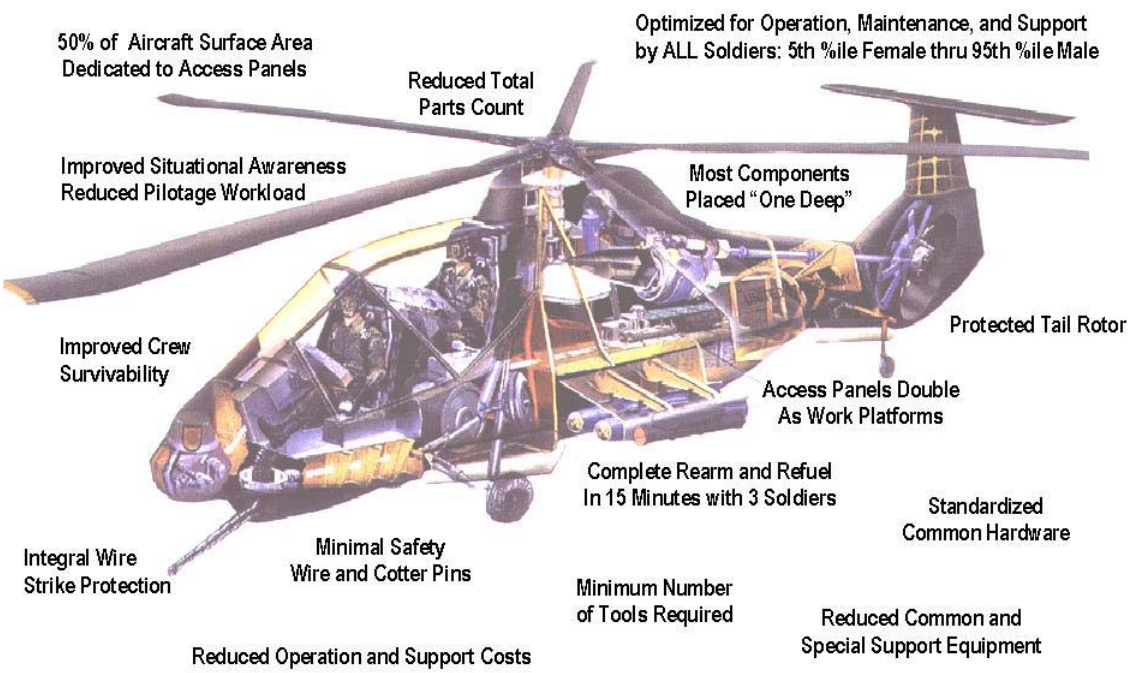
During the last several years, the Comanche Supportability Team focused on the principle that logistic support resources must be developed, acquired, tested, and deployed as an integral part of the Comanche System. This diverse team of soldiers, civilians, and contractor representatives provided the integrated logistics support expertise that supported:

- Support requirements definition
- Maintenance planning
- Supply support planning
- Support equipment identification
- Training program planning

- Facility planning and analysis
- Warranties definition
- Configuration management planning
- Quality program development
- Manpower and Personnel Integration (MANPRINT) program execution
- Environmental program planning

Entry into the engineering and manufacturing development (EMD) phase of the procurement process kicks off the formal transition from preliminary system design to design optimization for production and fielding. Within the Comanche Supportability community *[Integrated Logistic Support (ILS); Reliability, Availability, and Maintainability (R&M); Integrated Diagnostics (ID);*

Designed to be Supported in the Field



Continued from page 2

Transportability Accomplishments

C5 Galaxy
West Palm Beach to Andrews AFB

C-17 Globemaster
Andrews AFB to West Palm Beach

Configuration Management (CM); MANPRINT; Quality Assurance (QA); Environmental Program, and Training] entry into EMD also signals a change of our primary functions. The focus of our efforts is changing from up-front design influence and support planning to accomplishment of support-related tasks and execution of support plans.

Maintenance planning activities are ongoing, but we've shifted emphasis with conduct of maintainability demonstrations of user-level tasks using the Comanche prototype aircraft. As we gain experience supporting the prototype aircraft, previously defined reliability and maintainability (R&M) requirements are being tested to assess their impacts on required maintainer manning levels, personnel skill requirements, and spare and repair parts usage. Standardization and interoperability design decisions are streamlining our requirements for, and selection of, facilities, support equipment, test measurement diagnostic equipment (TMDE), fuel and munitions.

With implementation of the U.S. Army Training and Doctrine Command systems approach to training process, our Integrated Training Program is transitioning from the conduct of the analysis phase to the design and implementation of operator, maintainer and support personnel courses to train soldiers for participation in operational tests and experiments. Technical data and computer-resource requirements planning activities have evolved into management of the flood of Comanche-related data using comprehensive state-of-the-art management-information systems. Design influence relating to transportability of the RAH-66 has been tested with transportation of a prototype in both a C-17 and a C-5, and routine transportation of the aircraft using various commercial vehicles. Facilities-requirements planning is transitioning to on-site surveys of each base which will receive Comanches and determination of specific construction resource needs.

The Comanche supportability program is structured to be a continuous process that will control logistics life-cycle parameters that drive total system cost and readiness. Timely planning, development, acquisition and testing of required logistics resources will remain a part of the Comanche acquisition and system support process. The Comanche system design contains many examples of support-related successes in reducing system sustainment burdens.

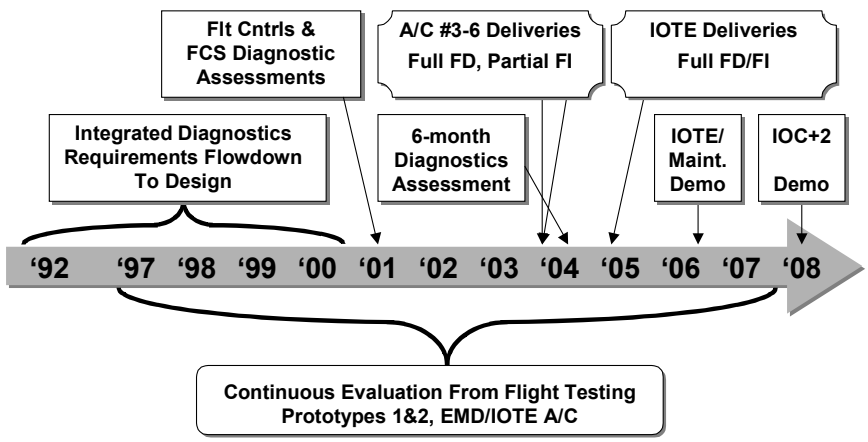
Continued from page 3

Comanche's design drives down maintenance and support requirements, resulting in reduced operation and support costs. Maintenance man-hours per flight-hour requirements are only a small percentage of current attack-aircraft burdens. This is achieved through stringent reliability requirements, an integrated diagnostics and prognostics capability at the subsystem level, functional partitioning and modular design of components for ease of maintenance, and use of a portable maintenance aid by the maintainer. The repair by replacement maintenance concept, verified through comprehensive repair-level analyses, requires only two maintenance levels, user and depot, and will be fielded within the existing three-level aviation maintenance and supply system. Ground support equipment, special tool and test-equipment requirements are reduced from current aircraft requirements. Only 49 common tools are required to perform all flight-line maintenance. Moreover, the aircraft can be completely rearmed and refueled in 15 minutes by three soldiers.

Comanche's maintenance burden is only 2.6 direct maintenance man-hours per flight hour. This is

achieved through aggressive application of reliability and maintainability, comprehensive integrated diagnostics requirements, and design characteristics. For example, the average time to complete essential maintenance actions is 1.0 hour; the average time to complete 90 percent of all user-level unscheduled maintenance actions is 2.3 hours. Comanche design also allows performance of all user-level maintenance tasks wearing mission oriented protective posture (MOPP)/Arctic gear with no more than a 25 percent degradation of performance requirements. Diagnostics characteristics are being aggressively pursued to ensure that 95 percent of all

Continuous Diagnostics Evaluation



Technical Risks:
Maturity of Aircraft Level Diagnostics

Risk Mitigation:
Phased Approach to Diagnostics Integration and Test, Aggressive Test-Analyze-Fix (i.e. FRACAS), Accelerate Production H/W and S/W Incorporation

Continued from page 4

electronic failures are automatically detected with 98 percent automated isolation of detected failures to the failed item. Mechanical / electrical requirements are 88 percent automatically detected with 80 percent automated isolation to the failed item.

During EMD, actual aircraft performance is being measured against all of these requirements. As system problems are encountered, root causes are determined and fixes implemented to ensure R&M requirements are met.

The Comanche is a low observable (LO) compliant weapon system whose LO features conform to the Comanche two-level maintenance concept, user, and depot. Within an LO context, support of the reduced radar signature creates the most challenge. The Comanche airframe is of entirely composite construction. As such, repair concepts follow typical composite repair schemes for each specific material type. Repair baseline procedures are fundamental and similar to those already performed on Army aircraft. Verification procedures for radar signatures are being developed in conjunction with the other services. Team Comanche personnel are part of a tri-service LO Supportability Working Group whose specific purpose is to share information between Department of Defense aircraft programs incorporating LO technology to enhance supportability.

Operator, maintainer and support personnel training is simplified and facilitated through improved simulations, virtual reality and embedded training capabilities. Flight simulators provide initial qualification and sustainment training of individuals, crews, and units for both individual and collective tasks. Maintainer training is accomplished using a combination of computer-based training, virtual reality simulations, and hands-on devices eliminating the need for dedicated aircraft. Embedded training features provide pilots with mission preview and collective training exercises, and provide maintainers troubleshooting practice with “just-in-time” training through the Portable Maintenance Aid.

FIX - ALL - FAILURES APPROACH

Surface, Track and Fix All Reliability, Maintainability, and Diagnostics "Failures"

Aircraft in for Maintenance

Remove and Examine the Part

Write Failure Analysis Report

Incorporate Fix

Reliability Growth Based on Corrective Action Implementation Schedule, Failure Fix Effectiveness, and Cumulative Flight Hours

Demonstrates Reliability Growth

Continued from page 5

COMANCHE TOOL KIT COMPARISON

During the Program Definition and Risk Reduction (PDRR) phase, supportability design influence activities considered all design levels (with emphasis placed at the component level) through the identification of key supportability elements and cost drivers, such as manpower, training, skill levels, RAM/Diagnostics, support equipment, spares, transportability and facilities. Emphasis was placed on eliminating user-level special tools, support equipment, and TMDE via design. The results of supportability considerations in design and trade-off studies are ensuring that the Comanche production configuration will achieve the proper balance between performance and supportability.

The fielded Comanche truly will be the soldier's aircraft. With its rugged survivability characteristics, integrated MEP providing high situational awareness, and awesome lethality, Comanche pilots will be more responsive to mission requirements and more productive. The aircraft has been designed to be extraordinarily maintainable and easily transportable. Through its unique construction, numerous access panels, easily accessible line-replaceable units/modules and advanced diagnostics, the RAH-66 possesses "designed-in" maintainability. The system includes a Portable Maintenance Aid that contains all the diagnostic and interactive electronic technical manuals needed to perform maintenance and support tasks. Comanche aircraft can be rapidly loaded or unloaded from C-130, C-141, C-17, and C-5 transport aircraft. For maintainers, the aircraft will need fewer special tools and no automatic test equipment.

Comanche meets the seven tenets of the new Army vision -- it is rapidly deployable, agile, versatile, lethal, survivable, sustainable, and responsive. It will work hand in glove with the developing Future Combat System family of ground vehicles to provide the combat overmatch needed for the 21st century. Comanche is an aircraft designed with input from real soldiers for total operation and support by real soldiers operating in real combat conditions.

Mr. Reading is Comanche Supportability Division Chief

White Sands Missile Range

Capabilities of the MANPRINT Group of the Materiel Test Directorate

November 2000

Introduction

Within the U.S. Army system acquisition process, MANPRINT encompasses seven domains associated with designing and evaluating the soldier-weapon system combination in the pursuit of optimal total system performance.

The 7 MANPRINT Domains

- Human Factors Engineering (HFE)
- System Safety
- Health Hazards
- Manpower
- Personnel
- Training
- Soldier Survivability

The MANPRINT group of the Materiel Test Directorate (MTD) at White Sands Missile Range (WSMR) specializes in the test and evaluation of the three domains of HFE, system safety, and health hazards during the conduct of developmental testing and operational testing of U.S. Army weapon systems. The MTD at WSMR is part of the Development Test Command, which is part of the Army Test and Evaluation Command.

Experience in MANPRINT Testing

Over the past twenty-five years, the MANPRINT group has evaluated the HFE, system safety, and health hazards aspects of a large variety of U.S. Army weapon systems, which include air defense systems; land combat weapon systems; communications, command, and control systems; and tactical fire control systems. The test activities of the MANPRINT group include preparing test plans, conducting the tests, assessing and analyzing the data, preparing the test reports, and presenting briefings of the test results.

HFE Evaluation

The HFE evaluations performed by the MANPRINT group typically include an assessment of

the conformance of the weapon system under test to the applicable provisions of MIL-STD-1472, *Human Engineering Design Criteria for Military Systems, Equipment, and Facilities*. The various HFE tests are performed in accordance with Army approved Test Operation Procedures (TOPs), such as Top 1-2-610, *Human Factors Engineering Test Procedures*, which was issued by the U.S. Army Test and Evaluation Command (now called the Development Test Command, or DTC). The types of HFE evaluations performed on weapon systems by the MANPRINT group include:

1. Lighting measurement
2. Steady state noise measurement
3. Impulse noise measurement
4. Temperature, humidity, and ventilation measurement
5. Visibility and field of view measurement
6. Speech Intelligibility measurement of communications systems
7. Workspace and anthropometrics measurement
8. Displays and controls evaluation
9. Force, torque, and weight measurements
10. Evaluation of labels, markings and technical manuals
11. Man-computer interface assessment
12. Assessment of New Equipment Training adequacy
13. Administering of interviews and questionnaires

The MANPRINT group has a variety of instrumentation for the gathering of human factors engineering data and they have experience and expertise in the use of this instrumentation. These instrumentation items include sound level meters, illumination meters, anemometers, Wet Bulb Globe Temperature devices, force and torque testers, anthropometric measurement devices, stopwatches,

Continued from page 7

cameras, and videotape recorders. The MANPRINT group also has experience and expertise in preparing and administering interview guides and questionnaires. Another area of expertise of the MANPRINT group is the design of experiments and the statistical analysis of experimental data.

System Safety Evaluations

The MANPRINT group has conducted many system safety evaluations of weapon systems and provided many safety release recommendations based on these system safety evaluations. A safety release recommendation is a document provided to DTC in support of DTC issuing a safety release, that permits soldiers to participate as operators and maintainers in the testing of a weapon system. The safety release also delineates any necessary safety limitations to the test activities. In preparing a safety release recommendation, personnel from the MANPRINT group review various safety documents regarding the weapon system under test and perform a safety inspection of the weapon system. The safety inspection addresses such areas as electrical hazards, mechanical hazards, fire and explosive hazards, mobility hazards, lifting hazards, and conformance to MIL-STD-882, *System Safety Program Requirements*, and MIL-STD-454, *Standard General Requirements for Electrical Equipment*. The system safety inspections are conducted in accordance with Army approved TOPs, such as TOP 10-2-508, *Safety and Health Hazard Evaluation—General Equipment*.

In addition to safety release recommendations, the MANPRINT group has provided many safety confirmation recommendations. A safety confirmation recommendation is a document provided to DTC in support of DTC issuing a safety confirmation, which is a certification required for the materiel release and fielding of a weapon system.

The MANPRINT group also conducts and prepares reports on system safety tests as part of a weapon system technical test or operational test. The activities involved in providing a safety confirmation recommendation or in conducting a system safety test during a technical or operational test are similar to the activities involved in providing a safety release recommendation, as described above.

Health Hazard Evaluations

The MANPRINT group performs evaluations of health hazards arising from noise levels, heat stress and toxic substance levels.

Noise Level Evaluation: MANPRINT group personnel are responsible for devising the test plan, gathering noise level data, and analyzing the data with respect to the limits specified in MIL-STD-1474, *Noise Limits for Army Personnel*.

Heat Stress Evaluations: The MANPRINT group personnel gather Wet Bulb Globe Temperature data and compare the results to the limits described in Medical Technical Bulletin 507 (TB Med 507), *Prevention, Treatment, and Control of Heat Injury*.

Evaluations of Toxic Substance Levels: The MANPRINT group personnel are responsible for devising the test plan and comparing the measured toxic substance levels to the limits specified by OSHA, but the actual measurements of the toxic substances are performed by the MTD Chemistry Laboratory.

Conclusion

The MANPRINT group of MTD at WSMR stands ready to support testing activities in the areas of HFE, system safety, and health hazards, and offers an extensive background of experience and expertise in these areas, as well as a "team player" attitude.

For more information, contact:

Robert Reynolds, 505-678-1943, rreynold@mt.wsmr.army.mil

David Moran, 505-678-7463, morandav@mt.wsmr.army.mil

Joel Fernandez, 505-678-7447, fernandj@mt.wsmr.army.mil

MANPRINT Training Schedule

MANPRINT ACTION OFFICER COURSE (MAOC)

CLASS	START DATE	END DATE	LOCATION
2001-704	11 Sep 2001	20 Sep 2001	Fort Belvoir, VA
2002-701	27 Nov 2001	06 Dec 2001	Ft Leonard Wood, MO
2002-001	28 Jan 2002	07 Feb 2002	ALMC, Fort Lee, VA
2002-702	26 Feb 2002	07 Mar 2002	Fort Bragg, NC
2002-703	09 Apr 2002	18 Apr 2002	Huntsville, AL
2002-704	04 Jun 2002	13 Jun 2002	Ft Leonard Wood, MO
2002-002	05 Aug 2002	15 Aug 2002	ALMC, Fort Lee, VA

MANPRINT TAILORED TRAINING (APPLICATIONS COURSE)

CLASS	START DATE	END DATE	LOCATION
2001-705	21 Aug 2001	23 Aug 2001	Warren, MI
2002-701	19 Mar 2002	21 Mar 2002	Fort Belvoir, VA
2002-702	30 Apr 2002	02 May 2002	Fort Rucker, AL
2002-704	25 Jun 2002	27 Jun 2002	Rock Island, IL
2002-703	20 Aug 2002	22 Aug 2002	Warren, MI
2002-705	10 Sep 2002	12 Sep 2002	Huntsville, AL
2002-706	24 Sep 2002	26 Sep 2002	Dover, NJ

(POC: Mr. Len Girling, COM (804) 765-4361, DSN 539-4361)

MANPRINT INFORMATION

Articles, comments, and suggestions are welcomed. Submit to: MANPRINT Quarterly, HQDA (DAPE-MR), 300 Army Pentagon, Washington, DC 20310-0300; DSN 223-8840, COM (703) 693-8840, FAX (703) 697-1283, E-mail: margaret.simmons@hqda.army.mil

---

MANPRINT Web Site: http://www.manprint.army.mil

POLICY: Department of the Army, ODCSPER, ATTN: DAPE-MR, 300 Army Pentagon, Washington, DC 20310-0300, DSN 225-7035, COM (703) 695-7035.

DIRECTORY OF DESIGN SUPPORT METHODS: Defense Technical Information Center–MATRIS Office, DTIC-AM, NAS NI Bldg, 1482, Box 357011, San Diego, CA 92135-7011, DSN 735-9414, COM (619) 545-9414, E-mail: ddsm@dticam.dtic.mil, and web site: http://dticam.dtic.mil/hsi/

MANPRINT DOMAIN POCs:

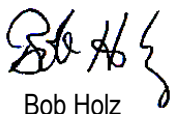
MANPOWER, PERSONNEL & TRAINING:
Mr. D. J. Imbs or Ms. Denise McCauley, U.S. Total Army Personnel Command, ATTN: TAPC-PLC-M, Alexandria, VA 22332-0406, DSN 221-2024 or 221-6489, COM (703) 325-2024 or 325-6489, FAX: (703) 325-0657, E-mail: imbs@hoffman.army.mil or mccauled@hoffman.army.mil

HUMAN FACTORS ENGINEERING: Dr. Edwin R. Smootz, Chief, Human Factors Integration Division, HRED, Army Research Laboratory, ATTN: AMSRL-HR-MV, Aberdeen Proving Ground, MD 21005-5425, DSN 298-5817, COM (410) 278-5817, FAX: 298-8823, E-mail: esmootz@arl.mil.

SYSTEM SAFETY: Col. Kim Welliver or Mr. Jim Patton, Office of the Chief of Staff, Army Safety Office, ATTN: DACS-SF, Crystal Plaza 5, Rm 980, 2100 S. Clark Street, Arlington, VA 22202, COM (703) 601-2405, Email: kim.welliver@hqda.army.mil, pattojt@hqda.army.mil.

HEALTH HAZARDS: Mr. Bob Gross or Maj. Carl Hover, U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), ATTN: MCHB-TS-OHH, Aberdeen Proving Ground, MD 21010-5422, DSN 584-2925, COM (410) 436-2925, FAX: 436-1016, E-mail: robert.gross@apg.amedd.army.mil or carlhover@apq.amedd.army.mil.

SOLDIER SURVIVABILITY: Mr. Richard Zigler, U.S. Army Research Laboratory, ATTN: AMSRL-SL-BE, Aberdeen Proving Ground, MD 21005-5068, DSN 298-8625, COM (410) 278-8625, FAX: 278-9337, E-mail: rzigler@mail.arl.mil.



Bob Holz
Acting Director for Personnel Technologies

The MANPRINT Quarterly is an official bulletin of the Office of the Deputy Chief of Staff for Personnel (ODCSPER), Department of the Army. The Manpower and Personnel Integration (MANPRINT) program (AR 602-2) is a comprehensive management and technical initiative to enhance human performance and reliability during weapons system and equipment design, development and production. MANPRINT encompasses the seven domains of personnel capabilities, manpower, training, human factors engineering, system safety, health hazards and soldier survivability. The focus of MANPRINT is to integrate technology, people and force structure to meet mission objectives under all environmental conditions at the lowest possible life-cycle cost. Information contained in this bulletin covers policies, procedures, and other items of interest concerning the MANPRINT Program. Statements and opinions expressed are not necessarily those of the Department of the Army. This bulletin is prepared quarterly under contract for the Personnel Technologies Directorate, Office of the Deputy Chief of Staff for Personnel under the provisions of AR 25-30 as a functional bulletin.

READER'S RESPONSE

Use this space to record changes, additions or deletions. Send your information by Fax (703) 697-1283 or Mail (fold on designated line and close (do not staple) with the MANPRINT Quarterly address on the Outside). If you are a MANPRINT POC for your organization, please check the MANPRINT POC block.

New		Delete		Change		MANPRINT POC	

Name _____
Rank/Title First M.I. Last

Company/Organization _____
Address _____
_____

Phone _____ FAX _____
DSN _____ FAX _____

E-mail Address _____
Comments _____
_____

Fold Here

From:

To:

MANPRINT Quarterly
HQDA (DAPE-MR)
300 Army Pentagon
Washington, DC 20310-0300

MANPRINT QUARTERLY
HQDA (DAPE-MR)
300 Army Pentagon
Washington, DC 20310-0300

FIRST CLASS